



MEMORANDUM

TO: Marchant Schneider Loudoun County
Art Smith Loudoun County
George Phillips Loudoun County
John Bassett VDOT

CC: Sara Howard-O'Brien Loudoun County Public Schools
Sam Adamo Loudoun County Public Schools

DATE: September 12, 2008

SUBJECT: Response to Comments for Traffic Impact Study - Loudoun County Public Schools
Lenah Property MS-5 and HS-7; SPEX 2008-0017 and CMPT 2008-0007

This document addresses the second referral comments received from **VDOT** for the traffic impact study prepared for Loudoun County Public Schools, Lenah Property MS-5 andHS-7; SPEX 2008-0017 and CMPT 2008-0007, Loudoun County, Virginia. Each comment is presented in *italics* with the response in **bold** immediately following.

COMMENTS:

- 1) Please see the attached e-mail and its associated memorandum both dated 08/26/2008 from Mr. Arsalan (Alex) Faghri of VDOT's Traffic Engineering Section. Please note in particular, comment #3.c.iii which indicates that exclusive left turn lanes are warranted on Lenah Road at both of the site access points.

Please see response to comment # 11.

- 2) Please see the attached e-mail dated Friday, August 08, 2008 from Mr. Cina Dabestani of VDOT's Transportation Planning Section.

Please see response to comment # 8.

- 3) At the August 5, 2008 meeting, it was agreed that Lenah Road, Route 600 should be constructed to the appropriate VDOT Geometric Standard (GS) as a full standard typical section from the Lenah Connector the site's second, westernmost access point.

LCPS proposes to extend the existing two-lane section of Lenah Road from Lenah Run Circle to the site's second, westernmost access point prior to the opening of the middle school. The construction of this extension will meet VDOT requirements. As a part of the Lenah Collector Road construction (by the Lenah residential subdivision) it is proposed to construct a T intersection and realign existing Lenah Road to connect the new Lenah Collector Road. This improvement is tied to the development of the residential subdivision and, as a part of the contract conditions for the purchase of the school site, this T intersection is to be constructed within 14 months after the transfer of the 350th residential lot to a third party.

- 4) Related to comment # 3: It was also agreed that the applicant would dedicate right of way 25' from centerline on Lenah Road, Route 600 along the entire site frontage.

Right of way will be dedicated as required.

- 5) Lenah Road Connector is specified as U4 typical section in the Loudoun Countywide Transportation Plan (CTP) from Tall Cedars Parkway to Route 50. It is our understanding that the ultimate 70' right of way dedication and a 2-lane section is proposed "By Others" from Braddock Road, Route 620 to Lenah Road (Realigned). We recommend the County pursue the third lane (i.e., the southbound lane on the western side of the road) through the limits of this property from this applicant.

VDOT is correct, the right of way dedication and the 2-lane section of the Lenah Road Connector will be constructed by others as a part of the land purchase contractual obligations and the Lenah residential subdivision. To confirm, the segment of the Lenah Road Connector between Braddock Road and the future Tall Cedars Parkway/southern site entrance will be constructed prior to the opening of the middle school and the segment from the southern site entrance to the realigned existing Lenah Road, including the T realignment will be constructed within 14 months of the transfer of the 350 residential lot to a third party. The Applicant notes that the third lane on the Lenah Connector Road is not warranted by the proposed school use.

6) *This applicant should provide the following road improvements by the school(s) planned opening date:*

- a. *Intersection of Route 50 and Lenah Road – Add traffic signal*
- b. *Intersection of Route 50 and Lenah Road – Add westbound left turn lane*
- c. *Intersection of Route 50 and Lenah Road – Add eastbound right turn lane*
- d. *Intersection of Route 50 and Lenah Road – Add northbound right turn lane*
- e. *Intersection of Braddock Road and Lenah Connector (aka, Lenah Loop Road) – Monetary contribution towards traffic signal.*

LCPS proposes to add a traffic signal and a westbound left turn lane at the intersection of Route 50 and Lenah Road. The capacity analysis shown in the traffic study dated February 15, 2008, shows that the following improvements are required at the intersection of Route 50 and Lenah Road:

- **Add traffic signal (existing conditions)**
- **Add westbound left turn lane (future conditions without school traffic)**
- **Add northbound right turn lane (future conditions with school traffic)**
- **Add eastbound right turn lane (future conditions with school traffic)**

It should be noted that the traffic study evaluates the worst-case scenario by analyzing traffic generated by the Schools with the peak hour of adjacent street traffic. Traffic counts reveal that the peak hour of adjacent street traffic is between 7:00 to 8:00 in the AM peak period and 4:45 to 5:45 in the PM peak period, whereas the peak hour for the School traffic is between 8:00 to 9:00 AM and 4:00 to 5:00 PM. As discussed in the July 16, 2008 memo, a revised capacity analysis was conducted for 2011 (MS+HS traffic) for the peak hour of generator. The capacity analysis results for the intersection of Route 50 and Lenah Road for the peak hour of school traffic are shown in table A on the next page.

Table A: Future Conditions with Development (2011) Intersection Capacity Analysis (Peak hour of Generator)

Intersection (Approach/Movement)	Total Future Conditions (2011)			
	AM Peak Hour		PM Peak Hour	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
US Route 50 and Lenah Road				
Overall (Signalized)	D	44.5	C	31.0
Eastbound Approach	D	50.5	A	10.0
Westbound Approach - Add Left turn lane	C	32.5	D	40.3
Northbound Approach	D	53.3	D	49.2
Southbound Approach	C	30.2	D	44.9

The results presented above show that the intersection of Route 50 and Lenah Road operates at acceptable levels of service conditions for the peak hour of generator (school peak) with the addition of a traffic signal and a westbound left turn lane. It should also be noted that the intersection will operate at acceptable levels of service for the commuter peak as well, with the reduced level of school traffic. LCPS has proffered these improvements at this intersection, which more than mitigate the impacts of the traffic generated by the Schools and solves a regional traffic issue. The Synchro analysis worksheets are shown in Appendix K of the July 16, 2008 memo and are attached for easy reference.

With regard to the contribution to a signal at the intersection of the Lenah Connector Road and Braddock Road, the traffic study found that a signalization is required from an operational point of view. The next step outlined by the VDOT guidelines is to check whether the signal is warranted based on the traffic volumes projected at that intersection. The warrant analysis reveals that a signal is not warranted under the 2020 traffic scenario. The warrant analysis MTSD spreadsheet is attached at the back of the memorandum.

- 7) Please provide a copy of the draft proffers to this office for review.

The County Staff has prepared and recommended Special Exception conditions for the proposed use. The conditions are included in the Staff Report of September 10, 2008.

- 8) Appendix D shows a map depicting Traffic Analysis Zones boundary for this study but I asked for a map showing

"school district boundary" on Loudoun County's TAZ. Please ask for correction of this map.

Comment acknowledged. Revised map showing "school district boundary" on Loudoun County's TAZ is attached.

- 9) *On Page 3 of the response document, the engineer fails to discuss/address the northbound right turn lane at the intersection of Rt. 50 and Lenah Road. This turn lane has been identified as a planned/recommended improvement due to site in the February 15, 2008 TIA. Please ensure this movement is included as a needed movement as a result of site generated traffic.*

The northbound right turn lane is 'warranted' under the existing conditions. The table below from the memorandum dated July 16, 2008 addressing the comments received from VDOT shows that the traffic volume under existing conditions warrants the northbound turn lane. The warrant analysis spreadsheet is shown on the next page.

Route 50 and Lenah Road - Northbound Right Turn Lane Required			
Scenario	Turn Lane Warranted	Traffic Volume	% Share of Future Traffic 2011
Existing 2007	<input checked="" type="checkbox"/>	209	55%
Future Background 2010		209	55%
School Traffic 2011 only		169	45%
Total (2011)		378	100%

In addition, as mentioned in response to comment # 6 above, it is important to note that Middle Schools in Loudoun County run on the following schedule: 8:40 AM to 3:28 PM, whereas the High Schools run on the following schedule: 9:00 AM to 3:48 PM. The traffic study evaluates the worst-case scenario by analyzing traffic generated by the Schools with the peak hour of adjacent street traffic. Traffic counts reveal that the peak hour of adjacent street traffic is between 7:00 to 8:00 in the AM peak period and 4:45 to 5:45 in the PM peak period, whereas the peak hour for the School traffic is between 8:00 to 9:00 AM and 4:00 to 5:00 PM. A revised analysis was conducted for 2011 (MS+HS traffic) for the peak hour of generator. The capacity analysis results for the intersection of Route 50 and Lenah Road are shown in table A on page 7:

Table A: Future Conditions with Development (2011) Intersection Capacity Analysis (Peak hour of Generator)

Intersection (Approach/Movement)	Total Future Conditions (2011)			
	AM Peak Hour		PM Peak Hour	
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Westbound Approach – Add Left turn lane	C	32.5	D	40.3
Northbound Approach	D	53.3	D	49.2
Southbound Approach	C	30.2	D	44.9

The results presented above show that the intersection of Route 50 and Lenah Road operates at acceptable levels of service conditions for the peak hour of generator (school peak) with the addition of a traffic signal and a westbound left turn lane. It should also be noted that the intersection will operate at acceptable levels of service for the commuter peak as well, with the reduced level of school traffic. LCPS has proffered these improvements at this intersection, which more than mitigate the impacts of the traffic generated by the Schools and solves a regional traffic issue.

Right Turn Lane Warrant Analysis (2-LANE)

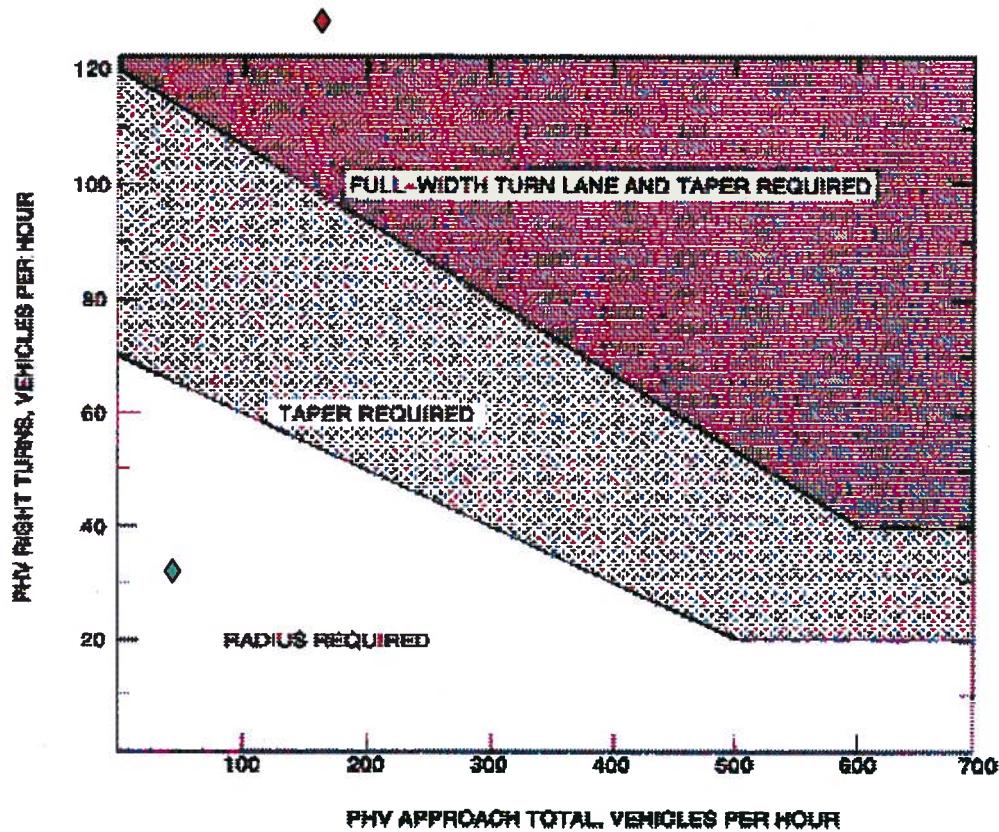
Route 50 and Lenah Road (Existing Conditions – 2007)

AM Peak Hour

Right Turn Volume = **178** veh/hour
Approach Volume = **188** veh/hour

PM Peak Hour

Right Turn Volume = **31** veh/hour
Approach Volume = **36** veh/hour



Right Turn Lane Required.

10) *Per Traffic Impact Analysis Regulations Administrative Guidelines, mitigation measures should be recommended for any movement with a LOS D or worse. The TIA appendix K "2011 TF Mitigated" for AM and PM Peak hours show LOS E for node 12 (Rt. 50 and Lenah Rd). This is a repeat comment. In the engineer's response to comments 15 and 16 we are referred to Appendices I and J, which are irrelevant to this discussion. Please check your work/response before submittal.*

The Loudoun County facilities standards manual recommends a level of service 'D' or better by approach. Node 12 (Route 50 and Lenah Road) in the Synchro analysis files shows that the intersection operates at acceptable levels of service (LOS D or better by approach) under future conditions (2011) with the school traffic in place. The westbound through-right movement operates at LOS E for the AM and PM peak period, however the westbound approach with the addition of the westbound left turn lane (proffered by the applicant) operates at LOS D for the AM and PM peak periods. It is also important to note that as shown in the traffic study dated February 18, 2008:

- Node 12 (Route 50 and Lenah Road) operates at overall LOS E under existing conditions (2007), and
- The westbound approach for node 12 fails at LOS F under the future conditions (2010) without the school traffic in place.
- The improvements proffered by the applicant (Signal and westbound left turn lane) clearly mitigate the impacts from the school traffic and also mitigate the impacts from the existing and regional traffic volume.

In addition, the appendices I and J referred to in the response memo are included in the back of the response memo dated July 16, 2008 (and in this memo for easy reference) and do not refer to the appendix from the original traffic study. We apologize for the confusion.

11) We disagree with the response given to Comment 9 which suggests using Passenger Car Equivalency (PCE) factor to the turning volumes along the three site driveways (intersections 4, 7, and 8) when performing turn lane warrant analysis. We made that comment because majority of the volumes using these driveways would be school buses. We disagree for the following reasons:

- a. Applying the PCE factor in situations where significant amount of truck traffic is present is standard procedure for capacity analyses recommended by the Highway Capacity manual. A factor of 1.5 is recommended for extended general highway segments on level terrains.
- b. The discussion provided by the engineer for critical gap is unjustifiable and irrelevant. Furthermore, increasing critical gap and follow-up time in Synchro by 25% wouldn't indicate if a turn lane is warranted and therefore is inapplicable. VDOT Road Design Manual Turn lane warrant analysis should be performed to determine if a turn lane is warranted.
- c. Appendix N "Turn Lane Warrants" in the February 2008 TIA is incorrect because:
 - i. On two lane roadways where there are no turn lane pockets, "Advancing Volume" and "Opposing Volume" includes the right and left turn lane volumes. It is not just the thru volumes. Please make sure all movements are included in the analysis.
 - ii. We were not able to verify the 87 veh./hour Opposing Volume in the analysis of 2011 TF for Lenah Road and School Entrance West (WBL). Please make sure correct volumes are used in the analysis.
 - iii. Even if PCE factor is not used, which we still strongly recommend to be used for consistency and accuracy, a WBL at intersection 4 and Intersection 7 is warranted. Please revise the analyses and resubmit.

Comment acknowledged. The left turn lane warrants for intersections 4 and 7 were reanalyzed based on VDOT's comments. The results reveal that a left turn lane is not warranted at intersection 7. The warrant analysis reveals that a left turn lane is barely warranted at intersection 4. Although, it should be noted that, the proposed site circulation plan will not allow any buses to enter intersection 4. LCPS separates the car and bus traffic to facilitate traffic flow at the proposed facilities. Intersection 4 serves the car parking lot. The bus traffic is directed to intersection 7 to the separate bus loop that will be located on the north side of the school.

The capacity analysis reveals that a left turn lane is not required at intersection 4 even with the inclusion of the bus traffic (Heavy vehicle percentage). The traffic along Lenah Road, which is less than 250 peak hour trips, even with the addition of school generated traffic, does not require turn lanes from an operation stand point. Gaps will be created for the school traffic and buses to enter the school entrances. Hence, a left turn lane is not recommended at intersection 4.

Left Turn Lane Warrant Analysis (2-LANE)

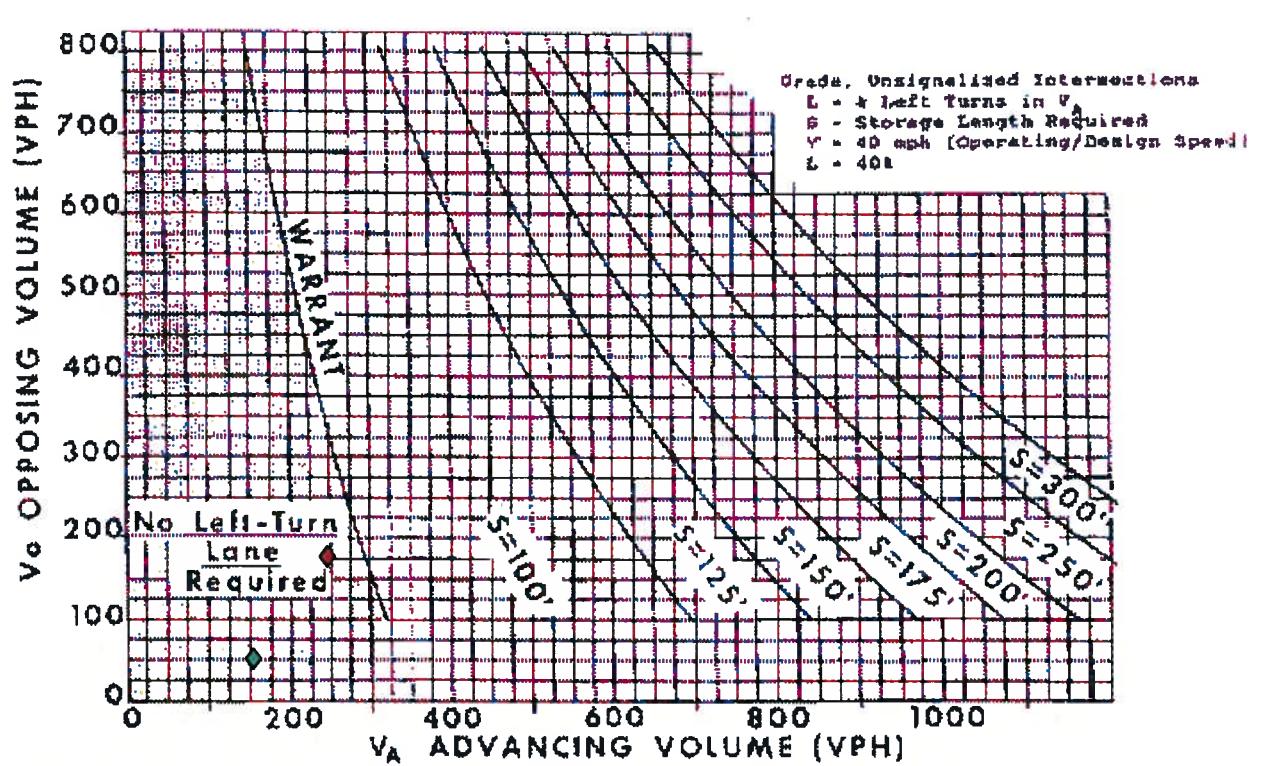
Intersection # 7: Lenah Road and Site Drive # 2

AM Peak Hour

Left Turn Volume = **215** veh/hour
Advancing Volume = **228** veh/hour
Opposing Volume = **163** veh/hour

PM Peak Hour

Left Turn Volume = **54** veh/hour
Advancing Volume = **157** veh/hour
Opposing Volume = **36** veh/hour



Left Turn Lane Not Required.

Left Turn Lane Warrant Analysis (2-LANE)

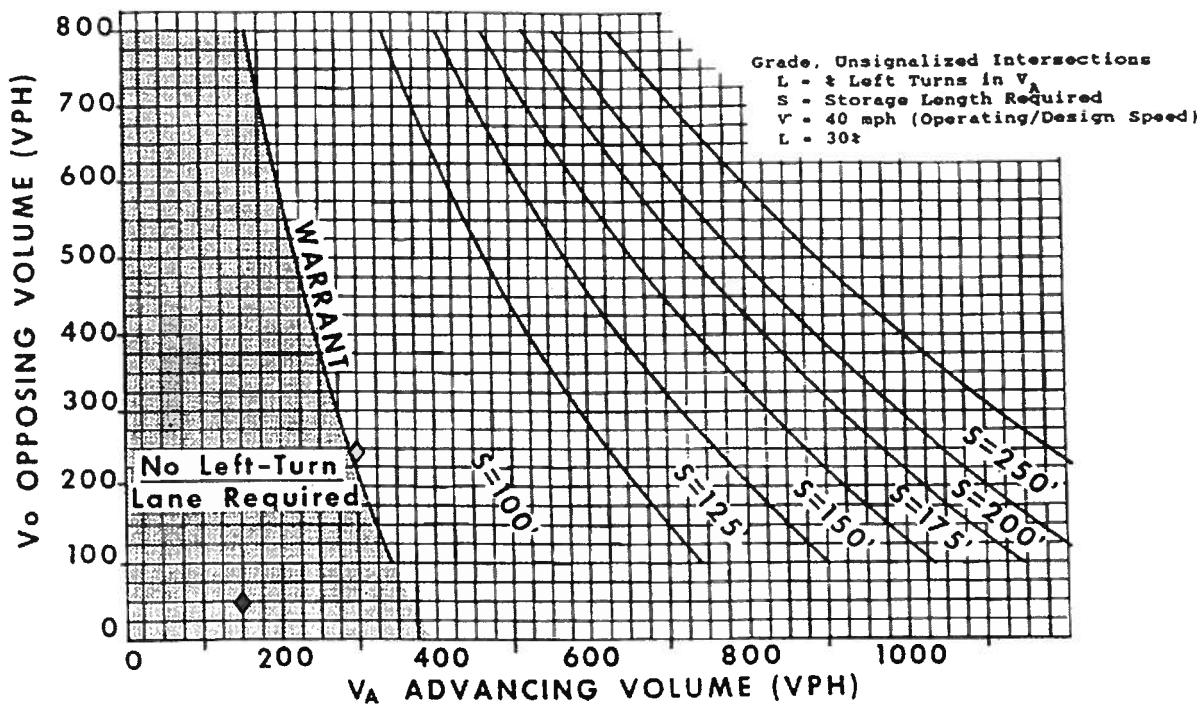
Intersection # 4: Lenah Road and Site Drive # 1

AM Peak Hour

Left Turn Volume = **101** veh/hour
Advancing Volume = **300** veh/hour
Opposing Volume = **241** veh/hour

PM Peak Hour

Left Turn Volume = **54** veh/hour
Advancing Volume = **157** veh/hour
Opposing Volume = **36** veh/hour



Left Turn Lane Required.

APPENDIX

TECHNICAL APPENDIX TABLE OF CONTENTS

APPENDIX A

Signal Warrant Analysis for the intersection of Braddock Road and Lenah Connector Road – Future Conditions with Development (2020)

APPENDIX B

Loudoun County's TAZ Map

APPENDIX I (*FROM JULY 16, 2008 RESPONSE MEMO*)

Intersection Capacity Analysis Results for Node 12 (Rt. 50 and Lenah) – Future Conditions with Proposed Development (2011 AM)

APPENDIX J (*FROM JULY 16, 2008 RESPONSE MEMO*)

Intersection Capacity Analysis Results for Node 12 (Rt. 50 and Lenah) – Future Conditions with Proposed Development (2011 PM)

APPENDIX K (*FROM JULY 16, 2008 RESPONSE MEMO*)

Intersection Capacity Analysis Results for Node 12 (Rt. 50 and Lenah) – Future Conditions with Proposed Development (2011) using Peak Hour of Generator

APPENDIX A

**SIGNAL WARRANT ANALYSIS FOR THE INTERSECTION OF BRADDOCK
ROAD AND LENAH CONNECTOR ROAD – FUTURE CONDITIONS WITH
DEVELOPMENT (2020)**

TRAFFIC SIGNAL WARRANTS (Lenah Loop Road and Braddock Road, TF 2020)

(Based on Estimated Average Daily Traffic - See Note 2)

URBAN		RURAL	
1. Minimum Vehicular		2. Interruption of Continuous Traffic	
Urban	Not Satisfied	Rural	Not Satisfied
<i>Number of lanes for moving traffic on each approach</i>		<i>Number of lanes for moving traffic on each approach</i>	
Major Street	Minor Street	Major Street	Minor Street
1	1	1	1
2 or more	1	2 or more	1
2 or more	2 or more	2 or more	2 or more
1	2 or more	1	2 or more
3. Combination		3. Combination	
Urban	Not Satisfied	Rural	Not Satisfied
<i>Vehicles per day on major Street (total of both approaches)</i>		<i>Vehicles per day on major Street (total of both approaches)</i>	
Urban	Rural	Urban	Rural
8,000	5,600	3,360	1,840
9,600	6,720	0	0
9,600	6,720	0	0
8,000	5,600	0	0
<i>Vehicles per day on higher-volume minor street (one direction only)</i>		<i>Vehicles per day on higher-volume minor street (one direction only)</i>	
Urban	Rural	Urban	Rural
2,400	1,680	1,200	850
2,400	1,680	1,200	850
3,200	2,240	1,600	1,120
3,200	2,240	1,600	1,120
<i>Actual</i>		<i>Actual</i>	
1. Left turn movements from the major street may be included with minor street volumes if a separate signal phase is to be provided for the left-turn movement.		1. Left turn movements from the major street may be included with minor street volumes if a separate signal phase is to be provided for the left-turn movement.	
2. To be used only for NEW INTERSECTIONS or other locations where actual traffic volumes cannot be counted.		2. To be used only for NEW INTERSECTIONS or other locations where actual traffic volumes cannot be counted.	
3. 25% of the Right turning traffic was considered.		3. 25% of the Right turning traffic was considered.	
<i>Note:</i>		<i>Note:</i>	
1. Left turn movements from the major street may be included with minor street volumes if a separate signal phase is to be provided for the left-turn movement.		1. Left turn movements from the major street may be included with minor street volumes if a separate signal phase is to be provided for the left-turn movement.	
2. To be used only for NEW INTERSECTIONS or other locations where actual traffic volumes cannot be counted.		2. To be used only for NEW INTERSECTIONS or other locations where actual traffic volumes cannot be counted.	
3. 25% of the Right turning traffic was considered.		3. 25% of the Right turning traffic was considered.	
<i>Must satisfy 80% of Warrants 1 and 2</i>		<i>Must satisfy 80% of Warrants 1 and 2</i>	

Note

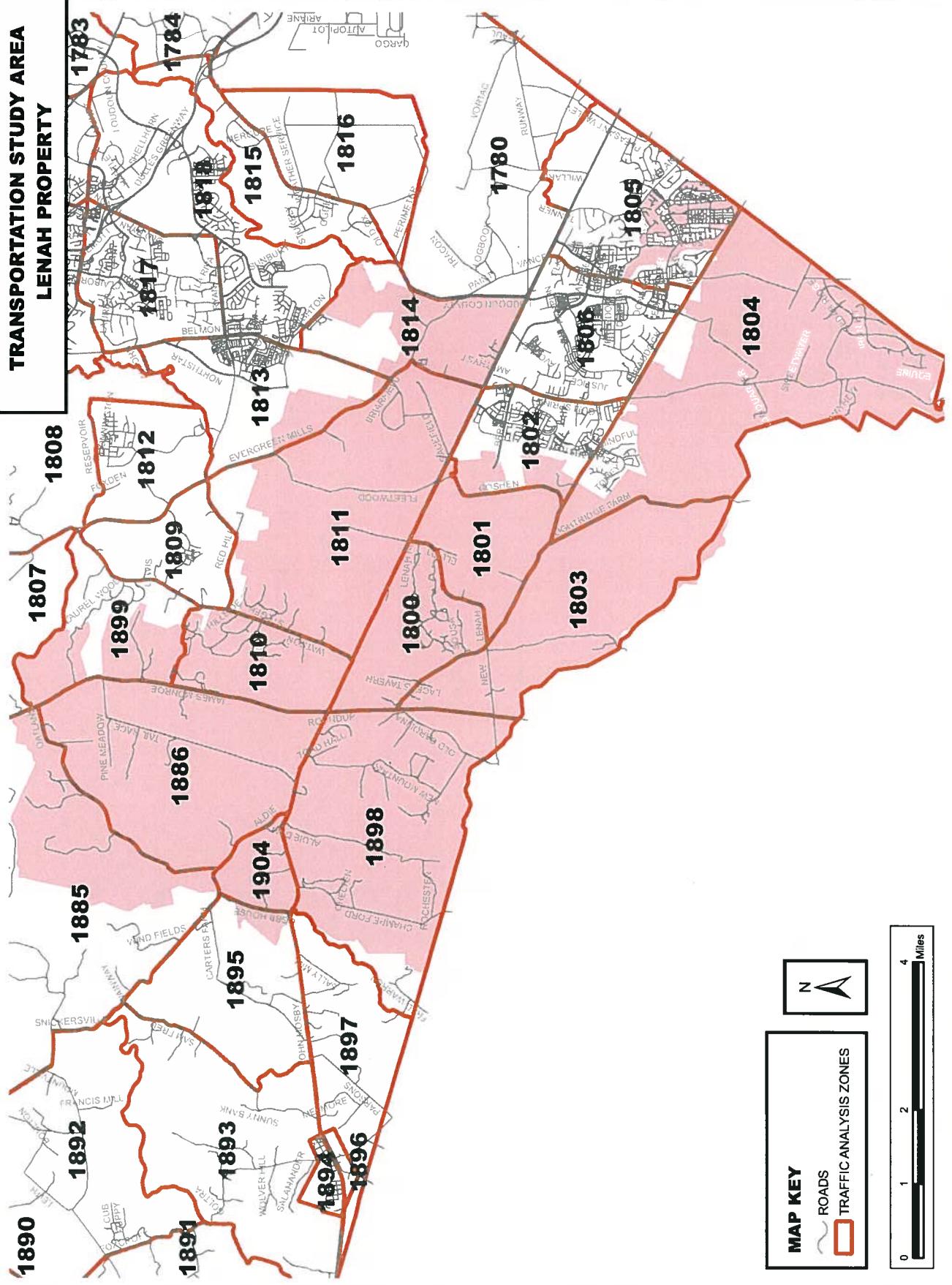
1. Left turn movements from the major street may be included with minor street volumes if a separate signal phase is to be provided for the left-turn movement.
 2. To be used only for NEW INTERSECTIONS or other locations where actual traffic volumes cannot be counted.
 3. 25% of the Right turning traffic was considered.

* Form is based on the sample form found in the Manual on Traffic Signal Design (MTSD) page 20.

APPENDIX B

LOUDOUN COUNTY'S TAZ MAP

**LOUDOUN COUNTY PUBLIC SCHOOLS
TRANSPORTATION STUDY AREA
LENAH PROPERTY**



HH2000	HH2005	HH2010	HH2015	HH2020	HH2025	HH2030	TAZ
23	23	23	23	23	23	23	1780
3	5	5	5	5	5	5	1781
0	0	0	0	0	0	0	1782
1	1	1	1	1	1	1	1783
5	5	5	5	5	5	5	1784
306	355	355	355	355	355	355	1785
218	451	525	538	1294	1568	1586	1786
3184	3187	3196	3200	3213	3294	3490	1787
1987	1991	1991	1993	1995	2076	2272	1788
681	910	964	1098	1098	1179	1375	1789
2117	2117	2117	2117	2117	2198	2395	1790
1249	1723	2067	2279	2344	2414	2483	1791
1229	1288	1288	1288	1378	1531	1537	1792
208	217	219	219	223	223	562	1793
663	663	663	663	743	790	812	1794
2506	3116	3389	3536	3536	3539	3580	1795
2954	2957	2959	2959	2959	3000	3082	1796
1201	1608	1617	1701	2020	2251	2372	1797
1086	1491	1492	1492	1492	1492	1492	1798
4676	4907	4995	5081	5289	5632	5796	1799
47	285	333	357	400	448	496	1800
53	54	54	169	217	796	983	1801
23	1154	3039	5405	5873	6016	6016	1802
61	70	76	211	240	790	1268	1803
61	110	349	974	2081	2546	2579	1804
1813	3195	3873	4881	5174	5446	5446	1805
549	2170	3939	4220	4382	4382	4382	1806
185	241	397	454	521	559	561	1807
35	40	453	599	642	666	671	1808
51	56	223	273	316	316	316	1809
40	47	94	146	189	191	193	1810
124	134	135	302	614	1391	2054	1811
26	28	130	159	241	251	251	1812
33	831	1980	3273	4507	5639	5639	1813
45	45	67	841	1926	1926	1926	1814
3	105	203	203	203	203	203	1815
3	3	3	3	3	3	3	1816
21	2097	3323	3954	4809	4923	4923	1817
261	1886	3565	4830	7183	7728	8232	1818
3237	4270	4780	5252	5298	5298	5298	1819
1656	1824	1825	2008	2008	2008	2008	1820
2098	2755	2764	2764	2764	2764	2764	1821
2213	3112	4173	5233	6202	6292	6382	1822
400	1038	1201	1736	2210	2300	2300	1823
287	1900	2573	2573	2573	2573	2573	1824
89	94	99	101	176	328	411	1825
131	157	167	213	332	451	461	1826
1488	1603	1608	1632	1656	1680	1681	1827
100	238	305	353	391	392	393	1828
95	295	360	398	441	484	484	1829
169	169	187	197	197	197	197	1830
2067	2785	2884	2932	2951	2953	2955	1831
438	1129	1198	1356	1821	2476	2619	1832
655	2551	3035	3327	3754	3759	3759	1833
205	2501	3575	4812	4812	4812	4812	1834
0	0	0	0	0	0	0	1835
12	21	21	21	21	21	21	1836
664	1136	1247	1509	3282	4184	4506	1837
14	14	14	624	956	1194	1223	1838
108	802	1328	2270	3077	3979	4301	1839
84	130	276	1103	1771	2059	2248	1840
2944	3079	3117	3266	3463	3549	3635	1841
2475	2598	2605	2605	2653	2777	2901	1842
141	180	210	261	327	375	409	1843
181	209	290	322	457	703	880	1844
142	146	155	159	163	167	171	1845
107	151	154	155	170	201	231	1846

TAZ	NewHU_2005	NewSFD_2005	NewSFA_2005	NewMF_2005	NewHU_2010
1836	9	9	0	0	0
1837	497	293	204	0	125
1838	0	0	0	0	0
1839	748	361	165	222	570
1840	48	48	0	0	153
1841	163	21	52	90	39
1842	129	95	30	4	7
1843	40	40	0	0	31
1844	29	29	0	0	85
1845	4	4	0	0	9
1846	46	46	0	0	3
1847	496	150	187	159	52
1848	37	37	0	0	227
1849	51	51	0	0	23
1850	0	0	0	0	0
1851	42	42	0	0	20
1852	0	0	0	0	0
1853	49	48	0	1	28
1854	60	60	0	0	43
1855	15	15	0	0	13
1856	96	96	0	0	79
1857	56	56	0	0	111
1858	2	2	0	0	233
1859	8	8	0	0	6
1780	0	0	0	0	0
1781	2	0	2	0	0
1782	0	0	0	0	0
1783	0	0	0	0	0
1784	0	0	0	0	0
1785	51	8	43	0	0
1786	245	0	245	0	78
1787	3	3	0	0	10
1788	4	0	4	0	0
1789	274	54	0	220	61
1790	0	0	0	0	0
1791	705	41	194	470	393
1792	62	9	53	0	0
1793	9	8	1	0	2
1794	0	0	0	0	0
1795	646	362	234	50	302
1796	3	2	1	0	2
1797	498	35	132	331	9
1798	642	12	0	630	1

1799	262	21	186	55	96
1800	250	250	0	0	50
1801	1	1	0	0	0
1802	1189	536	653	0	2015
1803	9	9	0	0	6
1804	51	51	0	0	255
1805	1467	1087	324	56	717
1806	1767	658	975	134	1864
1807	59	59	0	0	164
1808	5	5	0	0	438
1809	5	5	0	0	175
1810	7	7	0	0	50
1811	10	10	0	0	1
1812	2	2	0	0	110
1813	875	176	266	433	1219
1814	0	0	0	0	25
1815	106	106	0	0	103
1816	0	0	0	0	0
1817	2247	972	699	576	1295
1818	1733	773	673	287	1779
1819	1205	583	220	402	543
1820	177	120	57	0	1
1821	712	436	128	148	9
1822	989	22	674	293	1141
1823	721	120	97	504	173
1824	1697	849	848	0	725
1825	5	5	0	0	5
1826	26	26	0	0	10
1827	120	120	0	0	5
1828	144	144	0	0	71
1829	211	211	0	0	68
1830	0	0	0	0	19
1831	755	423	332	0	104
1832	765	316	283	166	72
1833	1998	922	1076	0	510
1834	2635	935	657	1043	1180
1835	0	0	0	0	0
1860	19	19	0	0	11
1861	40	40	0	0	43
1862	20	20	0	0	155
1863	67	67	0	0	47
1864	65	65	0	0	41
1865	48	48	0	0	81
1866	10	10	0	0	235

1867	37	37	0	0	28
1868	36	36	0	0	36
1869	2	2	0	0	1
1870	103	103	0	0	34
1871	61	61	0	0	13
1872	33	33	0	0	42
1873	52	52	0	0	79
1874	179	179	0	0	265
1875	25	25	0	0	9
1876	2	2	0	0	4
1877	169	135	34	0	122
1878	229	198	31	0	44
1879	450	450	0	0	308
1880	0	0	0	0	1
1881	47	47	0	0	70
1882	97	97	0	0	48
1883	22	22	0	0	27
1884	6	6	0	0	18
1885	15	15	0	0	31
1886	2	2	0	0	7
1887	35	35	0	0	25
1888	3	3	0	0	6
1889	11	10	0	1	4
1890	23	23	0	0	18
1891	12	12	0	0	2
1892	16	16	0	0	14
1893	3	3	0	0	6
1894	3	3	0	0	16
1895	7	7	0	0	0
1896	0	0	0	0	0
1897	24	10	14	0	8
1898	24	24	0	0	33
1899	10	10	0	0	58
1900	60	60	0	0	184
1901	219	180	36	3	95
1902	8	8	0	0	35
1903	13	13	0	0	20
1904	2	2	0	0	2
1905	0	0	0	0	0

NewSFD_2010	NewSFA_2010	NewMF_2010	NewHU_2015	NewSFD_2015	NewSFA_2015
0	0	0	0	0	0
17	0	108	285	90	0
0	0	0	656	0	392
128	136	306	1000	412	429
153	0	0	891	245	248
9	30	0	166	0	0
7	0	0	0	0	0
29	2	0	54	54	0
85	0	0	34	34	0
9	0	0	4	4	0
3	0	0	1	1	0
9	32	11	49	10	13
77	150	0	204	31	173
23	0	0	9	9	0
0	0	0	0	0	0
20	0	0	56	56	0
0	0	0	0	0	0
28	0	0	66	66	0
42	0	1	81	81	0
13	0	0	20	20	0
79	0	0	130	130	0
59	52	0	85	53	32
233	0	0	69	69	0
6	0	0	11	11	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
78	0	0	14	14	0
10	0	0	4	4	0
0	0	0	2	2	0
0	0	61	149	0	0
0	0	0	0	0	0
0	0	393	223	0	223
0	0	0	0	0	0
2	0	0	0	0	0
0	0	0	0	0	0
0	159	143	160	0	60
2	0	0	0	0	0
9	0	0	91	5	30
1	0	0	0	0	0

4	0	92	93	19	24
50	0	0	25	25	0
0	0	0	123.66	57	22
698	830	487	2519	991	987
6	0	0	144.66	78	22
219	36	0	660.66	562	54
637	80	0	1089	0	555
849	1015	0	296	144	130
164	0	0	60	60	0
402	36	0	154	154	0
154	21	0	53	53	0
50	0	0	55	55	0
1	0	0	181	40	42
86	24	0	30	30	0
407	812	0	1361	600	761
7	18	0	840	0	373
103	0	0	0	0	0
0	0	0	0	0	0
596	542	157	677	322	100
773	735	271	1351	191	797
208	178	157	517	112	35
1	0	0	193	100	93
9	0	0	0	0	0
313	493	335	1162	198	82
82	63	28	577	50	253
345	145	235	0	0	0
5	0	0	2	2	0
10	0	0	48	48	0
5	0	0	25	25	0
71	0	0	50	50	0
68	0	0	40	40	0
19	0	0	10	10	0
36	68	0	50	50	0
2	70	0	166	149	17
131	276	103	308	291	17
339	109	732	1367	0	127
0	0	0	0	0	0
11	0	0	26	26	0
43	0	0	54	54	0
155	0	0	8	8	0
47	0	0	91	91	0
41	0	0	88	88	0
81	0	0	97	97	0
212	23	0	291	281	10

28	0	0	33	33	0
35	1	0	0	0	0
1	0	0	2	2	0
33	0	0	13	13	0
13	0	0	5	5	0
42	0	0	45	45	0
79	0	0	33	33	0
265	0	0	317	317	0
9	0	0	4	4	0
4	0	0	2	2	0
112	10	0	45	45	0
34	10	0	51	14	11
308	0	0	90	90	0
1	0	0	11	11	0
70	0	0	65	65	0
48	0	0	42	42	0
27	0	0	25	25	0
18	0	0	40	40	0
31	0	0	58	58	0
7	0	0	24	24	0
25	0	0	22	22	0
4	2	0	6	6	0
4	0	0	4	4	0
18	0	0	17	17	0
2	0	0	2	2	0
14	0	0	13	13	0
6	0	0	6	6	0
10	6	0	42	42	0
0	0	0	0	0	0
0	0	0	0	0	0
8	0	0	8	8	0
33	0	0	35	35	0
58	0	0	105	105	0
184	0	0	150	150	0
85	10	0	155	155	0
35	0	0	35	35	0
20	0	0	95	95	0
2	0	0	5	5	0
0	0	0	0	0	0

NewMF_2015	NewHU_2020	NewSFD_2020	NewSFA_2020	NewMF_2020	NewHU_2025
0	0	0	0	0	0
195	1895	800	550	545	950
264	350	350	0	0	250
159	850	850	0	0	950
398	715	200	315	200	306
166	216	50	0	166	90
0	50	50	0	0	130
0	69	69	0	0	51
0	142	142	0	0	260
0	4	4	0	0	4
0	16	16	0	0	33
26	10	10	0	0	7
0	261	92	169	0	77
0	123	123	0	0	179
0	0	0	0	0	0
0	72	72	0	0	53
0	0	0	0	0	0
0	84	84	0	0	62
0	74	74	0	0	55
0	26	26	0	0	19
0	165	165	0	0	124
0	58	58	0	0	43
0	1	1	0	0	1
0	14	14	0	0	10
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	817	7	414	396	297
0	14	14	0	0	88
0	2	2	0	0	88
149	0	0	0	0	88
0	0	0	0	0	88
0	72	0	0	72	78
0	100	0	0	100	167
0	4	4	0	0	0
0	84	0	84	0	49
100	0	0	0	0	3
0	0	0	0	0	43
56	349	15	84	250	253
0	0	0	0	0	0

50	225	20	84	121	375
0	45	45	0	0	50
44.66	50	50	0	0	610
541	502	324	19	159	150
44.66	30	30	0	0	580
44.66	1166	1116	50	0	490
534	315	0	187	128	294
22	172	67	60	45	0
0	70	70	0	0	40
0	45	45	0	0	25
0	45	45	0	0	0
0	45	45	0	0	2
99	340	70	44	226	819
0	86	86	0	0	11
0	1300	600	700	0	1201
467	1190	0	282	908	0
0	0	0	0	0	0
0	0	0	0	0	0
255	925	65	366	494	125
363	2541	204	1137	1200	605
370	48	0	48	0	0
0	0	0	0	0	0
0	0	0	0	0	0
882	1069	69	63	937	100
274	509	0	319	190	100
0	0	0	0	0	0
0	79	79	0	0	161
0	125	125	0	0	125
0	25	25	0	0	25
0	40	40	0	0	1
0	45	45	0	0	45
0	0	0	0	0	0
0	20	20	0	0	2
0	490	490	0	0	690
0	450	450	0	0	5
1240	0	0	0	0	0
0	0	0	0	0	0
0	33	33	0	0	24
0	69	69	0	0	51
0	1	1	0	0	1
0	116	116	0	0	86
0	86	86	0	0	25
0	180	180	0	0	183
0	265	265	0	0	70

0	91	91	0	0	93
0	0	0	0	0	0
0	2	2	0	0	3
0	126	126	0	0	150
0	90	90	0	0	130
0	58	58	0	0	43
0	2	2	0	0	1
0	306	306	0	0	210
0	64	64	0	0	135
0	2	2	0	0	3
0	165	165	0	0	95
26	52	52	0	0	30
0	90	90	0	0	70
0	5	5	0	0	5
0	81	81	0	0	82
0	78	78	0	0	80
0	55	55	0	0	61
0	86	86	0	0	93
0	71	71	0	0	81
0	50	50	0	0	50
0	36	36	0	0	40
0	9	9	0	0	10
0	6	6	0	0	6
0	27	27	0	0	30
0	3	3	0	0	3
0	21	21	0	0	23
0	9	9	0	0	10
0	8	8	0	0	4
0	9	9	0	0	15
0	0	0	0	0	0
0	12	12	0	0	14
0	59	59	0	0	25
0	110	110	0	0	54
0	120	120	0	0	120
0	50	50	0	0	5
0	74	74	0	0	65
0	90	90	0	0	90
0	4	4	0	0	4
0	0	0	0	0	0

NewSFD_2025	NewSFA_2025	NewMF_2025	NewHU_2030	NewSFD_2030	NewSFA_2030
0	0	0	0	0	0
950	0	0	340	340	0
250	0	0	30	30	0
950	0	0	340	340	0
200	53	53	200	200	0
90	0	0	90	90	0
130	0	0	130	130	0
51	0	0	36	36	0
260	0	0	187	187	0
4	0	0	4	4	0
33	0	0	32	32	0
7	0	0	5	5	0
77	0	0	31	31	0
179	0	0	96	96	0
0	0	0	0	0	0
53	0	0	15	15	0
0	0	0	0	0	0
62	0	0	43	43	0
55	0	0	34	34	0
19	0	0	13	13	0
124	0	0	83	83	0
43	0	0	30	30	0
1	0	0	1	1	0
10	0	0	7	7	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	126	171	19	0	19
11	37	40	213	16	65
11	37	40	213	16	65
11	37	40	213	16	65
11	37	40	214	17	65
0	0	78	77	0	0
7	40	120	6	6	0
0	0	0	375	0	75
9	40	0	23	8	15
3	0	0	43	3	40
9	34	0	86	8	78
9	55	189	131	8	30
0	0	0	0	0	0

10	85	280	179	9	40
50	0	0	50	50	0
610	0	0	198	198	0
150	0	0	0	0	0
580	0	0	504	504	0
490	0	0	35	35	0
0	147	147	0	0	0
0	0	0	0	0	0
40	0	0	2	2	0
25	0	0	5	5	0
0	0	0	0	0	0
2	0	0	2	2	0
819	0	0	698	698	0
11	0	0	0	0	0
687	326	188	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	25	100	0	0	0
0	0	605	560	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	100	100	0	0
0	0	100	0	0	0
0	0	0	0	0	0
161	0	0	87	87	0
125	0	0	10	10	0
25	0	0	1	1	0
1	0	0	1	1	0
45	0	0	0	0	0
0	0	0	0	0	0
2	0	0	2	2	0
690	0	0	150	150	0
5	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
24	0	0	17	17	0
51	0	0	36	36	0
1	0	0	1	1	0
86	0	0	60	60	0
25	0	0	5	5	0
183	0	0	109	109	0
70	0	0	7	7	0

93	0	0	123	123	0
0	0	0	0	0	0
3	0	0	2	2	0
150	0	0	9	9	0
130	0	0	70	70	0
43	0	0	30	30	0
1	0	0	1	1	0
210	0	0	7	7	0
135	0	0	73	73	0
3	0	0	2	2	0
95	0	0	20	20	0
30	0	0	14	14	0
70	0	0	5	5	0
5	0	0	3	3	0
82	0	0	60	60	0
80	0	0	57	57	0
61	0	0	41	41	0
93	0	0	102	102	0
81	0	0	95	95	0
50	0	0	53	53	0
40	0	0	29	29	0
10	0	0	7	7	0
6	0	0	5	5	0
30	0	0	21	21	0
3	0	0	2	2	0
23	0	0	17	17	0
10	0	0	7	7	0
4	0	0	4	4	0
15	0	0	15	15	0
0	0	0	0	0	0
14	0	0	19	19	0
25	0	0	2	2	0
54	0	0	25	25	0
120	0	0	2	2	0
5	0	0	2	2	0
65	0	0	45	45	0
90	0	0	49	49	0
4	0	0	3	3	0
0	0	0	0	0	0

NewMF_2030	NewHU_0530	TAZ
0	0	1836
0	3595	1837
0	1286	1838
0	3710	1839
0	2265	1840
0	601	1841
0	317	1842
0	241	1843
0	708	1844
0	25	1845
0	85	1846
0	123	1847
0	800	1848
0	430	1849
0	0	1850
0	216	1851
0	0	1852
0	283	1853
0	287	1854
0	91	1855
0	581	1856
0	327	1857
0	305	1858
0	48	1859
0	0	1780
0	0	1781
0	0	1782
0	0	1783
0	0	1784
0	0	1785
0	1225	1786
132	329	1787
132	305	1788
132	511	1789
132	302	1790
77	843	1791
0	273	1792
300	381	1793
0	156	1794
0	508	1795
0	131	1796
93	833	1797
0	1	1798

130	968	1799
0	220	1800
0	982	1801
0	5186	1802
0	1265	1803
0	2607	1804
0	2415	1805
0	2332	1806
0	336	1807
0	667	1808
0	273	1809
0	154	1810
0	2039	1811
0	237	1812
0	5081	1813
0	2055	1814
0	103	1815
0	0	1816
0	3022	1817
560	6836	1818
0	1108	1819
0	194	1820
0	9	1821
100	3572	1822
0	1359	1823
0	725	1824
0	334	1825
0	318	1826
0	81	1827
0	163	1828
0	198	1829
0	29	1830
0	178	1831
0	1568	1832
0	1273	1833
0	2547	1834
0	0	1835
0	111	1860
0	253	1861
0	166	1862
0	400	1863
0	245	1864
0	650	1865
0	868	1866

0	368	1867
0	36	1868
0	10	1869
0	332	1870
0	308	1871
0	218	1872
0	116	1873
0	1105	1874
0	285	1875
0	13	1876
0	447	1877
0	191	1878
0	563	1879
0	25	1880
0	358	1881
0	305	1882
0	209	1883
0	339	1884
0	336	1885
0	184	1886
0	152	1887
0	38	1888
0	25	1889
0	113	1890
0	12	1891
0	88	1892
0	38	1893
0	74	1894
0	39	1895
0	0	1896
0	61	1897
0	154	1898
0	352	1899
0	576	1900
0	307	1901
0	254	1902
0	344	1903
0	18	1904
0	0	1905

APPENDIX I *(From July 16, 2008 Response Memo)*

INTERSECTION CAPACITY ANALYSIS RESULTS FOR NODE 12 (RT. 50 AND LENAH) – FUTURE CONDITIONS WITH PROPOSED DEVELOPMENT (2011 AM)

HCM Signalized Intersection Capacity Analysis
12: Route 50 & Lenah Road

Lenah Schools
6/18/2008

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	0.85	1.00	1.00	1.00	1.00	1.00	0.85	0.85	0.93	0.93	0.93
Flt Protected	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00	0.98	0.98	0.98
Satd. Flow (prot)	1863	1583	1770	1861			1770	1583	1583	1695		
Flt Permitted	1.00	1.00	0.06	1.00	1.00	1.00	0.76	1.00	1.00	0.90	0.90	0.90
Satd. Flow (perm)	1862	1583	106	1861			1409	1583	1583	1563		
Volume (vph)	2	1159	108	218	525	3	73	0	299	1	0	1
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	1260	117	237	571	3	79	0	325	1	0	1
RTOR Reduction (vph)	0	0	37	0	0	0	0	0	67	0	1	0
Lane Group Flow (vph)	0	1262	80	237	574	0	0	79	258	0	1	0
Turn Type	Perm		Perm	pm+pt			Perm		pm+ov	Perm		
Protected Phases		2		1	6			8	1		4	
Permitted Phases	2		2	6			8		8	4		
Actuated Green, G (s)	65.0	65.0	79.2	79.2			10.8	20.0			10.8	
Effective Green, g (s)	66.0	66.0	80.2	80.2			11.8	22.0			11.8	
Actuated g/C Ratio	0.66	0.66	0.80	0.80			0.12	0.22			0.12	
Clearance Time (s)	5.0	5.0	5.0	5.0			5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)	1229	1045	255	1493			166	412			184	
v/s Ratio Prot			c0.09	0.31				c0.06				
v/s Ratio Perm	c0.68	0.05	0.65				0.06	0.10			0.00	
v/c Ratio	1.03	0.08	0.93	0.38			0.48	0.63			0.01	
Uniform Delay, d1	17.0	6.1	36.7	2.8			41.2	35.3			38.9	
Progression Factor	1.00	1.00	1.00	1.00			1.00	1.00			1.00	
Incremental Delay, d2	32.7	0.1	37.3	0.8			2.1	3.0			0.0	
Delay (s)	49.7	6.2	74.0	3.6			43.4	38.2			38.9	
Level of Service	D	A	E	A			D	D			D	
Approach Delay (s)	46.1			24.2			39.2				38.9	
Approach LOS	D			C			D				D	
Intersection Summary												
HCM Average Control Delay	38.2				HCM Level of Service		D					
HCM Volume to Capacity ratio	0.97											
Actuated Cycle Length (s)	100.0				Sum of lost time (s)		12.0					
Intersection Capacity Utilization	106.1%				ICU Level of Service		G					
Analysis Period (min)	15											
c Critical Lane Group												

APPENDIX J *(From July 16, 2008 Response Memo)*

INTERSECTION CAPACITY ANALYSIS RESULTS FOR NODE 12 (RT. 50 AND LENAH) – FUTURE CONDITIONS WITH PROPOSED DEVELOPMENT (2011 PM)

HCM Signalized Intersection Capacity Analysis
12: Route 50 & Lenah Road

Lenah Schools
6/18/2008

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0				4.0	4.0			4.0
Lane Util. Factor	1.00	1.00	1.00	1.00				1.00	1.00			1.00
Fr _t	1.00	0.85	1.00	1.00				1.00	0.85			0.88
Flt Protected	1.00	1.00	0.95	1.00				0.95	1.00			1.00
Satd. Flow (prot)	1863	1583	1770	1862				1777	1583			1628
Flt Permitted	1.00	1.00	0.17	1.00				0.73	1.00			0.97
Satd. Flow (perm)	1863	1583	320	1862				1352	1583			1588
Volume (vph)	0	892	30	245	1570	2	29	1	79	1	0	8
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	970	33	266	1707	2	32	1	86	1	0	9
RTOR Reduction (vph)	0	0	9	0	0	0	0	0	72	0	8	0
Lane Group Flow (vph)	0	970	24	266	1709	0	0	33	14	0	2	0
Turn Type	Perm		Perm	pm+pt			Perm		pm+ov	Perm		
Protected Phases		2			1	6			8	1		4
Permitted Phases		2			2	6		8		8	4	
Actuated Green, G (s)	70.3	70.3	83.4	83.4				6.6	14.7			6.6
Effective Green, g (s)	71.3	71.3	84.4	84.4				7.6	16.7			7.6
Actuated g/C Ratio	0.71	0.71	0.84	0.84				0.08	0.17			0.08
Clearance Time (s)	5.0	5.0	5.0	5.0				5.0	5.0			5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0				3.0	3.0			3.0
Lane Grp Cap (vph)	1328	1129	402	1572				103	328			121
v/s Ratio Prot	0.52			0.06	c0.92				0.00			
v/s Ratio Perm			0.01	0.50				c0.02	0.01			0.00
v/c Ratio	0.73	0.02	0.66	1.09				0.32	0.04			0.01
Uniform Delay, d1	8.6	4.2	11.9	7.8				43.8	35.0			42.7
Progression Factor	1.00	1.00	1.00	1.00				1.00	1.00			1.00
Incremental Delay, d2	3.6	0.0	4.1	50.3				1.8	0.1			0.0
Delay (s)	12.2	4.2	15.9	58.1				45.6	35.0			42.8
Level of Service	B	A	B	E				D	D			D
Approach Delay (s)	11.9			52.5				37.9				42.8
Approach LOS	B			D				D				D
Intersection Summary												
HCM Average Control Delay		38.8			HCM Level of Service				D			
HCM Volume to Capacity ratio		1.02										
Actuated Cycle Length (s)		100.0			Sum of lost time (s)				8.0			
Intersection Capacity Utilization		148.0%			ICU Level of Service				H			
Analysis Period (min)		15										
c Critical Lane Group												

APPENDIX K *(From July 16, 2008 Response Memo)*

INTERSECTION CAPACITY ANALYSIS RESULTS FOR NODE 12 (RT. 50 AND LENAH) – FUTURE CONDITIONS WITH PROPOSED DEVELOPMENT (2011) USING PEAK HOUR OF GENERATOR

HCM Signalized Intersection Capacity Analysis
12: Route 50 & Lenah Road

Lenah Schools
TF 2011 (Peak Hour of Generator)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0				4.0			4.0
Lane Util. Factor	1.00			1.00	1.00				1.00			1.00
Fr _t	0.99			1.00	1.00				0.90			0.95
Flt Protected	1.00			0.95	1.00				0.99			0.98
Satd. Flow (prot)	1838			1770	1861				1655			1750
Flt Permitted	1.00			0.07	1.00				0.91			0.88
Satd. Flow (perm)	1838			126	1861				1527			1567
Volume (vph)	0	999	111	213	580	3	85	0	245	1	1	1
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1052	117	224	611	3	89	0	258	1	1	1
RTOR Reduction (vph)	0	19	0	0	0	0	0	119	0	0	1	0
Lane Group Flow (vph)	0	1150	0	224	614	0	0	228	0	0	2	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		2			1	6			8			4
Permitted Phases	2				6		8			4		
Actuated Green, G (s)	54.0		64.7	64.7				15.3				15.3
Effective Green, g (s)	55.0		65.7	65.7				16.3				16.3
Actuated g/C Ratio	0.61		0.73	0.73				0.18				0.18
Clearance Time (s)	5.0		5.0	5.0				5.0				5.0
Vehicle Extension (s)	3.0		3.0	3.0				3.0				3.0
Lane Grp Cap (vph)	1123		214	1359				277				284
v/s Ratio Prot	0.63		c0.08	0.33								
v/s Ratio Perm			c0.68					c0.15				0.00
v/c Ratio	1.02		1.05	0.45				0.82				0.01
Uniform Delay, d ₁	17.5		30.9	4.9				35.5				30.2
Progression Factor	1.00		1.00	1.00				1.00				1.00
Incremental Delay, d ₂	33.0		74.3	1.1				17.7				0.0
Delay (s)	50.5		105.3	6.0				53.3				30.2
Level of Service	D		F	A				D				C
Approach Delay (s)	50.5			32.5				53.3				30.2
Approach LOS	D			C				D				C
Intersection Summary												
HCM Average Control Delay	44.5			HCM Level of Service				D				
HCM Volume to Capacity ratio	0.98											
Actuated Cycle Length (s)	90.0			Sum of lost time (s)				8.0				
Intersection Capacity Utilization	124.0%			ICU Level of Service				H				
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
12: Route 50 & Lenah Road

Lenah Schools
TF 2011 (Peak Hour of Generator)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00			1.00	1.00			1.00			1.00	
Fr _t	1.00			1.00	1.00			0.91			0.98	
Flt Protected	1.00			0.95	1.00			0.99			0.96	
Satd. Flow (prot)	1854			1770	1862			1667			1748	
Flt Permitted	1.00			0.20	1.00			0.91			0.61	
Satd. Flow (perm)	1854			368	1862			1531			1113	
Volume (vph)	0	867	32	188	1595	3	31	5	80	5	0	1
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	913	34	198	1679	3	33	5	84	5	0	1
RTOR Reduction (vph)	0	1	0	0	0	0	0	79	0	0	1	0
Lane Group Flow (vph)	0	946	0	198	1682	0	0	43	0	0	5	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		2			1	6			8			4
Permitted Phases	2				6		8			4		
Actuated Green, G (s)	72.7			85.0	85.0			5.0			5.0	
Effective Green, g (s)	73.7			86.0	86.0			6.0			6.0	
Actuated g/C Ratio	0.74			0.86	0.86			0.06			0.06	
Clearance Time (s)	5.0			5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0			3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	1366			433	1601			92			67	
v/s Ratio Prot	0.51			0.04	c0.90							
v/s Ratio Perm				0.36				c0.03			0.00	
v/c Ratio	0.69			0.46	1.05			0.47			0.08	
Uniform Delay, d ₁	7.1			7.5	7.0			45.5			44.4	
Progression Factor	1.00			1.00	1.00			1.00			1.00	
Incremental Delay, d ₂	2.9			0.8	37.1			3.7			0.5	
Delay (s)	10.0			8.3	44.1			49.2			44.9	
Level of Service	A			A	D			D			D	
Approach Delay (s)	10.0				40.3			49.2			44.9	
Approach LOS		A			D			D			D	
Intersection Summary												
HCM Average Control Delay	31.0				HCM Level of Service			C				
HCM Volume to Capacity ratio	1.01											
Actuated Cycle Length (s)	100.0				Sum of lost time (s)			8.0				
Intersection Capacity Utilization	148.2%				ICU Level of Service			H				
Analysis Period (min)	15											
c Critical Lane Group												